HATCHERY EVALUATION REPORT

Oxbow Hatchery - Spring Chinook (Clackamas Stock)
December 1996

Integrated Hatchery Operations Team (IHOT)

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Oxbow Hatchery - Spring Chinook (Clackamas Stock)

An Independent Audit Based on Integrated Hatchery Operations Team (IHOT) Performance Measures

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Section 1

Executive Summary

This report presents the findings of the independent audit of the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program. Oxbow Hatchery is located approximately 2 miles east of Cascade Locks, Oregon. Herman Creek Ponds, Lower Herman Creek Ponds, and Wahkeena Pond are operated as satellite facilities to Oxbow Hatchery. The hatchery is used for incubation and early rearing of Spring Chinook, Fall Chinook, and Coho.

The audit was conducted in 1996-1997 as part of a 2-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) "Strategy for Salmon" and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995).* That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility management's response to a 109-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters.
- The hatchery manager was asked to fill out and return the audit form.
- A 1-2 day site audit visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans.

- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.

- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Oxbow Hatchery - Spring Chinook (Clackamas Stock) Results

The Oxbow Hatchery includes 12 concrete raceways, incubation, and early rearing facilities. Oxbow Hatchery was originally constructed in 1913 to provide additional rearing facilities for Bonneville Hatchery. It was relocated to its present site in 1937 following construction of Bonneville Dam. Oxbow was operated as part of the Columbia River Fisheries Development Program (Mitchell Act) - a program to enhance declining fish runs in the Columbia River Basin.

The Oxbow Hatchery - Spring Chinook (Clackamas Stock) program was in general compliance with most of the performance measures. The audit found that the hatchery was not in compliance with the water quality monitoring requirements, needed double screen for a portion of the raceways, and needed bird netting for the raceways. The hatchery was not in compliance with the requirements for regional oversight of feed manufacturing, and needed to develop specific incubation and rearing standards. In the area of fish health, the hatchery was not using foot baths for the incubation facility.

The specific areas in which the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in alphabetical order without intent of ranking or otherwise assigning priority:

- Develop and maintain alarm log
- Develop specific rearing standards for the IHOT Operations Plan
- Develop specific incubation standards for the IHOT Operations Plan; review loading criteria for incubation
- Follow IHOT recommendations for regional oversight of feed production
- Install bird netting over raceways
- Install double screen on 12 raceways used for spring chinook
- Monitor and document DO and TGP levels
- Provide foot baths for incubation facility
- Review IHOT temperature criteria for rearing
- Run analysis for water chemistry parameters, alkalinity, hardness, nitrite, and contaminants

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 3, Section 4 of this report) were not listed above.

Section 2

Facility Description

Name: Oxbow Hatchery

Stock/Species: Coho - Tanner Creek Stock (Umatilla Releases)
Coho - Tanner Creek Stock (CEDC Releases)
Coho - Mixed Tanner Creek/Sandy River Stock (CEDC Releases)
Coho - Tanner Creek Stock (Bonneville Releases)
Spring Chinook (Clackamas Stock)

Operating Agency: Oregon Department of Fish & Wildlife

Funding Agency: Mitchell Act

Location: Oxbow Hatchery is located approximately 2 miles east of Cascade Locks, Oregon.

Address: Oxbow Fish Hatchery
Oregon Department of Fish & Wildlife
Star Route, Box 750
Cascade Locks, OR 97014

Hatchery Manager: Mr. Larry Dimmick

Phone: (541) 374-8540
Fax: (503) 374-8827

Purpose: Oxbow Hatchery was originally constructed in 1913 to provide additional rearing facilities for Bonneville Hatchery. It was relocated to its present site in 1937 following construction of Bonneville Dam. Oxbow was operated as part of the Columbia River Fisheries Development Program (Mitchell Act) - a program to enhance declining fish runs in the Columbia River Basin.

The goal of the hatchery is to produce coho and spring chinook that will contribute to the Northeast Pacific and Columbia River commercial, tribal, and sports fisheries.

Production Goal: **Coho**

Produce 2 million fingerlings (83,850 lb) at Upper Herman Creek for

transfer to Bonneville

Produce 0.825 million fingerlings (at Lower Herman Creek Ponds (Tanner Creek Stock) for transfer to Lower Columbia River net pens

Produce 0.600 million fingerlings at Lower Herman Creek Ponds (Mixed Tanner Creek and Sandy River Stock) for transfer to Lower Columbia River net pens

Produce 500,000 smolts (33,300 lb) at Lower Herman Creek Ponds for release into the Umatilla River.

Spring Chinook

Produce 637,000 fingerlings (5,095 lb) for transfer to Clackamas Hatchery

Water Supply:

The hatchery obtains its water supply from Oxbow Springs through gravity flow. The Oxbow Springs flow dwindles to about 300 gpm in the summer and fall and is not used for rearing fish during that period.

Facilities:

Adult Holding:	None
Incubation:	32 deep troughs - 28 cf each
	32 shallow troughs - 13 cf each
Early Rearing:	32 deep troughs - 28 cf each
	32 shallow troughs - 13 cf each
Raceways:	12 concrete raceways - 4,695 cf each
Rearing Ponds:	None
Satellite Facilities:	Herman Creek Satellite
	2 concrete raceways - 2,604 each
	2 Asphalt ponds - 46,900 cf each
	Lower Herman Creek Satellite
	3 concrete ponds - 10,800 cf each
	Wahkeena Satellite
	1 18 acre pond

Section 3

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in ***Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*** (referred to as *IHOT 1995* in this report).[1] The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audit included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 109-page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Two additional sections (sections 1 and 8) include general information and expenditure information needed for this Hatchery Evaluation Report and blank forms for additional comments. The following is the basic structure of the IHOT audit form:

Section 1	Performance Measures for General Information and Expenditure Information (PMs General 1-2)
Section 2	Performance Measures for Program Objectives (PMs 1-4)
Section 3	Performance Measures for Facility Requirements (PMs 5-15)
Section 4	Performance Measures for Hatchery Practices (PMs 16-25)
Section 5	Performance Measures for Fish Health Policy (PMs 26-34)
Section 6	Performance Measures for Ecological Interactions (PMs 35-38)
Section 7	Performance Measures for Genetics Policy (PMs 39-43)
Section 8	Blank Forms for Additional Comments

Several performance measures are repeated in various sections of the audit form. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by shaded text.

The Hatchery Audit Process

[1]Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

The hatchery audit will be conducted over a 2-year period that concludes in 1997. At each hatchery, a five-step process was used to complete the overall hatchery audit. This process consisted of research and onsite visits. The site visit at the Oxbow Hatchery was conducted on October 29, 1996.

The following is the five-step audit process:

1. Information was obtained from headquarters.

2. The hatchery manager was asked to fill out and return the **Audit Form**.

3. A 1-2 day site audit visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.

4. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative. A portion of the Hatchery Evaluation Report was sent to the hatchery manager following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.

5. Information from steps 1-4 was used to prepare a draft **Hatchery Evaluation Report**. This draft report was submitted to the operating agencies for review of the information used to determine compliance. Based on review and comments, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Oxbow Hatchery - Spring Chinook (Clackamas Stock)

The following table includes information on life-stages that are held on this facility for some portion of their rearing cycle (Table 1). For multi-facility programs, summary cost and contribution data is presented at the facility where rearing occurs. For the compliance status relating to performance measures that do not occur at this hatchery, please refer to the Hatchery Evaluation Reports for the hatcheries and stocks listed in Table 1. A check mark (✔) indicates that the specific life-stage is held at this facility.

This section documents the compliance status of the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program. Each performance measure is presented in a table taken from the audit form (Table 2). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4 of this report, where the cost of the required remedial actions is also presented.

Table 1 Summary Program Information for Oxbow Hatchery - Spring Chinook (Clackamas Stock)

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Clackamas Hatchery	Oxbow Hatchery				
Adult Collection	✔					
Adult Holding	✔					
Spawning	✔					
Fertilization	✔					
Incubation						
green-to-eyed	✔					
eyed-to-hatch		✔				
Rearing						
fry		✔				
fingerlings		✔				
smolts	✔					
Acclimation/release	✔					

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
the hatchery programs outlined in a subbasin nagement plan?		✔			ODF&W fish production schedule; Clackamas River Basin Plan	
ne hatchery operating under a current hatchery rational plan?		✔			IHOT Operations Plan	
s it understood by staff?		✔				
s it being followed?		✔				
hatchery monitoring and evaluation plan in place?						
Do you have a written monitoring and evaluation plan?		✔			CWT program described in IHOT Operations Plan	
ult contribution to fisheries, spawning grounds, and chery	✔				Review of records. Reported for Clackamas Hatchery	
ult pre-spawning survival as compared with blished goal	✔				Held at Clackamas Hatchery	
g-take as compared with established hatchery goal	✔				Egg-take at Clackamas Hatchery	
en-egg to eyed-egg survival as compared with blished goal	✔				At Clackamas Hatchery	
d-egg to fry survival as compared with established l		✔			Review of records; in compliance 3 out of last 3 years	
to smolt survival as compared with established goal	✔				Transferred to Clackamas Hatchery	
duction as compared with established goal		✔			Review of records; in compliance 3 out of last 3 years	
cent survival (smolt to adult) as compared with blished goal	✔				Reported at Clackamas	
nber of eggs, fry, fingerlings, smolts, and/or adults neet basinwide needs	✔				Review of records/Discussion. Reported at Clackamas	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
nperature						
Does your water temperature meet the criteria for spawning?	✔				Spawning at Clackamas Hatchery	
Does your water temperature meet the criteria for ncubation?		✔			Review of records	
Does your water temperature meet the criteria for earing?				✔	Constant 45°F; Meet production goals	Review IHOT temperature criteria for rearing
solved gases						
s the oxygen level near saturation?			✔		Measured; but not recorded. No problems	Monitor and document DO levels
s the dissolved nitrogen level less than saturation?			✔		No data (no problems)	Monitor TGP
emistry						
mmonia (un-ionized)			✔		No recent data	Run analysis
arbon Dioxide			✔		No recent data	Run analysis
hlorine			✔		No recent data	Run analysis
H			✔		No recent data	Run analysis
opper			✔		No recent data	Run analysis
ydrogen Sulfide			✔		No recent data	Run analysis
on			✔		No recent data	Run analysis
inc			✔		No recent data	Run analysis
bidity						
Does your turbidity meet the criteria?		✔			Oxbow Springs water has no visible turbidity	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
alinity and hardness						
Does your alkalinity and hardness meet the criteria?			✔		No recent data	Run analysis
rite						
Does your nitrite meet the criteria?			✔		No recent data	Run analysis
Contaminants						\
ldrin			✔		No data	Run analysis
ndrin			✔		No data	Run analysis
Dieldrin			✔		No data	Run analysis
Heptachlor			✔		No data	Run analysis
Chlordane			✔		No data	Run analysis
Methoxychlor			✔		No data	Run analysis
indane			✔		No data	Run analysis
Malathion			✔		No data	Run analysis
Guthion			✔		No data	Run analysis
hogens						
What portions of the hatchery have disease-free water?						
Adult holding	✔				No adult holding	
Incubation		✔			Oxbow Springs	
Early rearing		✔			Oxbow Springs	
Rearing	✔				At Clackamas Hatchery	
Others	✔				At Clackamas Hatchery	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
rm Systems						
)o the following areas have alarms?						
Intake		✔			Inspection of facilities	
Large rearing ponds and adult holding ponds		✔			Inspection of facilities	
Raceway headboxes and rearing ponds		✔			Inspection of facilities	
Incubation facilities		✔			Inspection of facilities	
Quarantine areas and facilities	✔				None at hatchery	
Water treatment systems	✔				None at hatchery	
Security				✔	No security problems	Install security alarms
ıre there outside systems and buzzers in onsite esidences?		✔			Discussion	
ıre water flow alarms checked daily?		✔			Review of records/Discussion	
ıre all other alarms checked weekly?	✔				No other types	
; there a log of alarms for emergencies, tests, and ıaintenance requirements?				✔	Inspection/Discussion	Develop and maintain log for alarms
ıre telephone pagers used?		✔			Use radio pagers	
ılt collection and holding facilities						
)o you meet the adult holding criteria?	✔				At Clackamas Hatchery	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ıbation facilities						
'ype 1: shallow troughs)o you have an adequate number of units for the verall program?		✔			Valves on headbox need updating but still function	
'ype 2: deep troughs)o you have an adequate number of units for the verall program?		✔			Valves on headbox need updating but still function	
ıring facilities						
'ype 1: concrete raceways)o you have an adequate number of units for the verall program?		✔			Raceways need resurfacing and leakage repair, but still functioning	
'ype 2: _____)o you have an adequate number of units for the verall program?	✔					
'ype 3: _____)o you have an adequate number of units for the verall program?	✔					
eening facilities						
)o you meet the approach velocity criteria?	✔				Spring water supply; screens not needed	
ıre the fish screens regularly cleaned?	✔				See above	
)oes the screen mesh meet screen opening criteria?	✔				See above	
ıre rearing containers double screened for fish that hould not be released to adjacent water?				✔	None on raceways	Install double screens on raceways used for spring chinook
dator control facilities						
ıre your predation control facilities effective?				✔	Inspection of facilities/Discussion	Install bird netting over raceways

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
d storage facilities and quality control						
)oes the storage of dry/semi-moist/moist foods dry<12%; semi-moist 12-20%; moist >20% moisture) ollow food manufacturer's recommendations?		✔			Discussion with regional quality control (QC) officer	
)oes a regional quality control officer oversee roduction procedures and monitor:						
Verification by feed manufacturer that ingredients meet specifications?				✔	See above	Follow IHOT recommendations for regional oversight of feed production
Ensure feed does not contain unwanted drugs or other additives?				✔	See above	See above
Analyze ingredients contained in the final food product to ensure that feed specifications have been met?				✔	See above	See above
ıre the foods stored and handled according to the ollowing criteria?						
Moist pellets should not exceed 10 °F at point of delivery.			✔		Don't measure; delivered in refrigerated truck	None
Moist pellets should be removed from freezer just prior to feeding.		✔			Discussion	
Do not leave buckets of feed or feed containers outside exposed to light or heat.		✔			Discussion	
Open bags of feed should be fed within 1 to 2 days except when feeding small groups of fish.		✔			Discussion	
Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).		✔			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ease facilities						
)o the release facilities ensure that fish are not ubjected to adverse conditions?	✔				Transferred to Clackamas Hatchery prior to release	
lution abatement facilities						
)o the pollution abatement facilities meet all federal nd state regulations (or good engineering practice)?		✔			Inspection of facilities/Discussion	
ıre pollution abatement facilities operated correctly?		✔			Discussion	
nsportation facilities						
ıre the transport systems adequate to meet IHOT erformance measures for transportation practices?		✔			Use Clackamas Hatchery transport trucks	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
odstock selection practices						
s the donor selection process document attached? (PM 40a)	✔				Existing program; does not apply	
Was the donor selection outline followed in selecting ne hatchery broodstock? (PM #40b-c)	✔				Existing program; does not apply	
wning practices						
Were the appropriate number of spawners, male/female atios, and fertilization protocols used? (PM #42c-g)	✔				At Clackamas Hatchery	
ıbation practices						
specific incubation standards listed in the hatchery rations plan?				✔	Review of IHOT Operations Plan	Develop specific incubation standards for the IHOT Operations Plan
incubation practices written?				✔	See above	See above
ıbation Type 1: shallow troughs (see PM #8) you meet the loading and flow criteria?				✔	Meet flow; do not meet loading criteria	Review loading criteria for incubation
ıbation Type 2: deep troughs (see PM #8) you meet the loading and flow criteria?				✔	Meet flow; do not meet loading criteria	Review loading criteria for incubation

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ring practices						
specific rearing standards listed in the hatchery rations plan?				✔	Review of Hatchery Operations Plan	Develop written rearing standards and practices
rearing practices written?				✔	See above	See above
earing Unit Type 1: concrete raceways see PM #9)						
Do you meet the density and DI criteria?			✔		No specific criteria	Develop density & DI criteria
Do you meet the Loading and FI criteria?			✔		No specific criteria	Develop loading & FI criteria
earing Unit Type 2: (see PM #9)						
Do you meet the density and DI criteria?	✔					
Do you meet the Loading and FI criteria?	✔					
earing Unit Type 3: (see PM #9)						
Do you meet the density and DI criteria?	✔					
Do you meet the Loading and FI criteria?	✔					
olt quality						
Do you produce a high quality smolt?	✔				Transferred prior to this stage	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
h health management practices						
re the monthly hatchery monitoring visits being onducted? (PM #26)		✔			Review of records at regional lab by audit team pathologist	
re the annual broodstock inspections being conducted? PM #27)		✔			Review of records at regional lab by audit team pathologist	
there pathogen-free water (PM #5b) and are the anitation procedures being followed? (PM #28)		✔			No incubation at this hatchery	
re the following water quality parameters within riteria? (PM #5a-5g)						
Water temperature				✔	Review of records/Discussion	See PM #5a
Dissolved gases			✔		No dissolved nitrogen data	See PM #5b
Chemistry			✔		No data	See PM #5c
Turbidity		✔			Discussion	
Alkalinity and hardness			✔		No data	See PM #5e
Nitrite			✔		No data	See PM #5f
Contaminants			✔		No data	See PM #5g
re rearing standards being followed? (PM #19)				✔	Discussion	See PM #19
re egg and fish transfer/release requirements met? PM #31)		✔			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
s hatchery performance meet requirements lined in the regional hatchery policies and in basin and hatchery plans for the following areas?						
cent smoltification						
Do you measure percent smoltification?	✔				Transferred to Clackamas prior to this stage	
Did you meet the smoltification criteria?	✔				Transferred to Clackamas prior to this stage	
ring density (prior to release)						
Did you meet the rearing density criteria just prior to elease?	✔				Transferred to Clackamas prior to this stage	
ease condition (at release)						
Did you meet all disease regulations just prior to elease?	✔				Transferred to Clackamas prior to this stage; obtain OK prior to transfer	
nber (at release)						
Did you meet the release number goal?	✔				Number transferred met goal ; do not release from Oxbow	
at release						
Did you meet the size goal?	✔				Size at transfer generally meets goal ; do not release from Oxbow	
es of release						
Did you meet the release date goal?	✔				Dates at transfer generally meet goal ; do not release from Oxbow	
ation of release						
Did you release the fish at the specified location?	✔				Transferred to Clackamas	
fish reared in the subbasin or acclimated in the basin?						
are the fish reared in the subbasin?				✔	Majority of rearing (weight gain) at Oxbow Hatchery	None
are the fish acclimated in the subbasin?		✔			At Clackamas Hatchery	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ıe release strategy appropriate for the program?	✔				Do not release from Oxbow	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
nsportation facilities						
)o transportation equipment and personnel receive isinfection before and after use?	✔				Use Clackamas transport vehicles	
s the fish tank interior disinfected using a solution of 00 ppm active chlorine for 30 minutes minimum or ormaldehyde gas generation method (relative humidity f 60% for 2 hrs)?	✔				See above	
Is the exterior of the fish transport vehicle disinfected using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?	✔				See above	
s the fish transport vehicle (cab) disinfected using 600 pm quaternary ammonia compounds (1.5 ml of 50% tock solution/liter water)?	✔				See above	
s other equipment disinfected including fish pumps, ets, egg sorters, waders, boots, rain gear, hoses and ther equipment using one of the following solutions?	✔				See above	
200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes		✔			Discussion	
)o personnel wear protective garments when handling sh eggs or cultural water?		✔			Discussion	
)o the fish transport truck/chassis and tank/unit receive n inspection and service prior to the release season?	✔				Use Clackamas transport vehicles	
s a daily service inspection completed before starting p and leaving for the day?	✔				See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
nsportation facilities						
)oes the fish transport unit receive an inspection prior) loading?	✔				Use Clackamas transport vehicles	
)oes a pre-loading inspection covering tank water evel, pumps or aerators, oxygen injection system ettings, displacement gauge, and truck loading/hauling ensity tables checked and reviewed occur prior to)ading fish in the transport unit?	✔				See above	
)o hauling criteria include checking the fish 45 minutes) 1 hour after loading?	✔				See above	
Vhen fish are active and systems are functioning roperly, is the oxygen concentration reduced and naintained at approximately 8 ppm?	✔				See above	
s water temperature in the transportation unit naintained within the 42-48 °F range?	✔				See above	
)o fish releasing procedures include the following riteria?	✔				See above	
Releasing the fish at the correct release site or into the correct water body.	✔				See above	
Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.	✔				See above	
The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.	✔				See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
luation practices						
las the hatchery conducted fishery contribution studies o:						
Determine the requirements for evaluating and improving management programs?		✔			CWT program	
Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?		✔			See above	
Develop guidelines that define if the proper stocks of fish are currently being used?		✔			See above	
Determine which management units contribute to a specific fishery and the time periods of those contributions?		✔			See above	
Determine the relative contributions of the various management units to a specific fishery over the different time periods?		✔			See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ining practices						
Does the hatchery have a training schedule for its staff?		✔			Discussion	
Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		✔			Discussion	
Does the hatchery routinely exchange training details between other hatcheries and agencies?		✔			Discussion	
Does the hatchery encourage and reward off-duty training of staff?		✔			Discussion	
Does the hatchery conduct monthly staff meetings?		✔			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
monthly hatchery monitoring visits being ducted by a qualified fish health specialist as cribed below?						
Conduct visit at least monthly		✔			Review of regional lab records by audit team pathologist	
Monitoring conducted by qualified fish health specialist		✔			Review of regional lab records by audit team pathologist	
Examine a representative sample of healthy and moribund fish from each lot.		✔			Review of regional lab records by audit team pathologist	
Review fish culture practices with hatchery manager.		✔			Review of regional lab records by audit team pathologist	
Report finding and results of necropsies on standard form.		✔			Review of regional lab records by audit team pathologist	
Recommend appropriate drug or chemical treatment.		✔			Review of regional lab records by audit team pathologist	
Summarize fish health status or stock prior to release or transfer to another facility.		✔			Review of regional lab records by audit team pathologist	
all of the functions of the hatchery yearly nitoring visits being completed as described below?						
Annually examine each broodstock for the presence of reportable viral pathogens.	✔				At Clackamas	
Annually screen each salmon broodstock for the resence of *Renibacterium salmoninarum*.	✔				see above	
Conduct inspection by or under the supervision of ualified fish health specialist.	✔				see above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ıe hatchery following accepted sanitation cedures?						
ıre there any sources of pathogen-free water, especially or incubation and early rearing?		✔			Inspection/Discussion	
ıre the hatchery sanitation procedures understood and eing followed as described below?						
Disinfect/water harden eggs in iodophor?		✔			Inspection of facilities/Discussion	
Are foot baths containing disinfectant placed at the incubation facility's entrance and exit?				✔	Inspection of facilities/Discussion	Provide foot baths
Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?		✔			Inspection of facilities/Discussion	
Is equipment used to collect dead fish sanitized prior its use in another pond and/or lot of fish?		✔			Inspection of facilities/Discussion	
Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?		✔			Inspection of facilities/Discussion	
Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?		✔			Inspection of facilities/Discussion	
Are dead fish properly disposed of?		✔			Inspection of facilities/Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
water quality parameters being followed?						
re the following water quality parameters within riteria? (PM #5a-5g)						
Water temperature				✔	Does not meet criteria for rearing	See PM #5a
Dissolved gases			✔		No dissolved nitrogen data	See PM # 5b
Chemistry			✔		No data	See PM #5c
Turbidity		✔			Discussion	
Alkalinity and hardness			✔		No data	See PM #5e
Nitrite			✔		No data	See PM #5f
Contaminants			✔		No data	See PM #5g
o to PM #21						
incubation and rearing standards being followed?						
Are the incubation practices following the IHOT incubation criteria? (PM #18)				✔	Review of records/Discusion	See PM #18
Are the rearing practices following the IHOT criteria? (PM #19)				✔	Review of records/Discusion	See PM #19
o to rearing practices PM #18-PM #19						
egg and fish transfer/release requirements met?		✔			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ne hatchery's program outlined in a subbasin nagement plan? Go to subbasin plan PM #1		✔			ODF&W fish production schedule	
ne hatchery operating under a current hatchery rational plan? Go to operational plan PM #2		✔			Review of IHOT Operations Plan	
hatchery monitoring and evaluation plan in place? Go to hatchery monitoring and evaluation plan PM #3		✔			M&E program described in IHOT Operations Plan	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
s the hatchery program meet requirements blished in the regional hatchery policies and basin planning documents in the following areas: cies, stock, broodstock collection location, odstock numbers, broodstock collection strategy, spawning and egg-take protocols?						
Does the hatchery program meet the requirements for he following?						
Species protocols (PM #4a)	✔				All at Clackamas Hatchery	
Stock protocols (PM #4a)	✔				See above	
Broodstock collection location protocols (PM #41b)	✔				See above	
Broodstock numbers protocols (PM #42c)	✔				See above	
Broodstock collection strategy protocols (PM #41b-d)	✔				See above	
Spawning protocols (PM #42d-e)	✔				See above	
Egg-take protocols (PM #42f-g)	✔				See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
s the hatchery's performance meet requirements ined in the regional hatchery policies and in basin and hatchery plans for the following areas: cent smoltification, rearing density, disease dition, and the number, size date(s), and location of ase?						
ercent smoltification (PM #22a1)	✔				Transferred to Clackamas Hatchery	
earing density (PM #22a2)	✔				See above	
isease condition (PM #22a3)	✔				See above	
umber at release (PM #22a4)	✔				See above	
ize at release (PM #22a5)	✔				See above	
ate of release (PM #22a6)	✔				See above	
ocation of release (PM #22a7)	✔				See above	
fish reared in the subbasin or acclimated in the basin? PM #22b	✔				Transfer to Clackamas Hatchry for release	
e release strategy appropriate for the program? PM #22c	✔				Not release at Oxbow	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
new programs, has a broodstock collection plan n developed?						
s the broodstock collection plan written?	✔				Existing Program; does not apply	
or a non-captive broodstock program:	✔				Existing Program; does not apply	
Was an unbiased, representative sample collected?						
Was the recommended number of broodstock collected?	✔				Existing Program; does not apply	
or a captive broodstock program:						
Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program?	✔				Existing Program; does not apply	
Were full-sib crosses avoided?	✔				Existing Program; does not apply	
s the broodstock collection plan understood and being ollowed by staff?	✔				Existing Program; does not apply	
a new program, was the donor selection outline owed in selecting the hatchery broodstock?						
s a donor selection plan written?	✔				Existing Program; does not apply	
Was the donor selection outline followed in selecting ne broodstock?	✔				Existing Program; does not apply	
Was the target stock recommended in the donor election process actually used?	✔				Existing Program; does not apply	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
existing programs, were the broodstock collection cedures followed?						
s the broodstock collection plan written?	✔				Brood not collected at this facility	
Does the broodstock collection plan follow the uideline:						
Was an unbiased, representative sample collected?	✔				See above	
Was the recommended number of broodstock collected?	✔				See above	
Were the broodstock collection procedures in hatchery operation plan understood and followed?	✔				See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
s the appropriate number of spawners, male/female os, and fertilization protocols used?						
ıre the spawning protocols written?	✔				At Clackamas Hatchery	
ıre daily or weekly spawning logs available?	✔				See above	
Vas the appropriate number of spawners used?	✔				See above	
)id you attempt to spawn all collected broodstock and ındomize mating with respect to age class, and other ·aits?	✔				See above	
Vas the sex-ratio within the limits given in the erformance standards?	✔				See above	
Vere the fertilization protocols followed?	✔				See above	
: the hatchery needed to reduce the number of eggs etained, was this done by representative sampling of ach male/female cross?	✔				See above	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ıere a genetics monitoring and evaluation program lace?						
; a genetics monitoring and evaluation program vailable?	✔				Responsibility of Clackamas Hatchery	
)oes the plan address the following elements listed in HOT:					See above	
Does the program have elements needed to meet evaluation goals 1-4?	✔				See above	
Has a qualified geneticist reviewed and endorsed the program (goal 5)?	✔				See above	
Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?	✔				See above	
Is the program understood and followed by staff?	✔				See above	

Section 4

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control, to those that require a change in agency policy or procedures, to those that involve a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but are not clearly definable at this time

Remedial Actions at Oxbow Hatchery - Spring Chinook (Clackamas Stock)

This section presents the corrective actions required to bring the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program into compliance with IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 3).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented, and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates (± 40%).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 3. Remedial Actions Required at Oxbow Hatchery - Spring Chinook (Clackamas Stock)

Remedial Action Required	Cost	PMs[1]
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery		
Install security alarms	----	
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Develop and maintain alarm log	----	6
Review IHOT temperature criteria for rearing	----	5a
Follow IHOT recommendations for regional oversight of feed production	----	12
Develop specfic incubation standards for the IHOT Operations Plan; review loading criteria for incubation	----	18
Develop specfic rearing standards for the IHOT Operations Plan	----	19
Provide foot baths for incubation facility	----	28
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Monitor and document DO and TGP levels	----	5b
Run analysis for water chemistry parameters, alkalinity, hardness, nitrite, and contaminants	----	5c, 5e, 5f, & 5g

[1] PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Remedial Action Required	Cost	PMs[1]
Type 4 - Remedial actions requiring significant capital expenditures		
Install double screen on 12 raceways used for spring chinook	$2,400	10
Install bird netting over raceways	$30,000	11
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time		
None	----	

[1] PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Section 5

Hatchery Contribution to Fisheries, Spawning Grounds, and Hatcheries

This section presents the audit findings for the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program contribution of adult fish to fisheries, local fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2-, 3-, 4-, 5-, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4 to 5 years after the fish have been released from the hatchery.

Table 4. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries: Oxbow Hatchery - Spring Chinook (Clackamas Stock)

Year	Fisheries[1] (Broodyear)	Spawning Grounds (Broodyear)	Hatchery[1] (Broodyear)	Total Combined Contribution[2] (Broodyear)	Smolt to Adult Survival (percent)
1984					
1985					
1986					
1987	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery
1988	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery
1989	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery
1990	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery
1991	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery	See Clackamas Hatchery
1992					

[1] Data obtained from Missing Production Groups Annual Report or from the Regional Mark Information System database.

[2] Total combined adult contribution; presented when it is not possible to subdivide the contribution into fisheries, spawning grounds, and hatchery contributions.

Section 6

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program was estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 5 shows the annual operating expenses for the Oxbow Hatchery - Spring Chinook (Clackamas Stock) program. For programs that occur at more than one facility (as shown on Table 1 in Section 3 of this report), the cost breakdown for the component(s) at each facility is presented in separate tables (Table 5a).

Table 5. Annual Operating Expenses: Oxbow Hatchery - Spring Chinook (Clackamas Stock)

Hatchery	**1993**	**1994**	**1995**
1. Oxbow Hatchery	$19,356	$14,661	$10,804
2. Clackamas Hatchery	$469.316	$469.316	$469.316
3.			
4.			
5.			
Total Program Costs	**$488,672**	**$483,977**	**$516,883**

The total expenditures for the Oxbow Hatchery are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery are presented in separate tables (Tables 6a, 6b, 6c, 6d, and 6e).

Table 6. Annual Operating Expenses - Oxbow Hatchery

Program	1994	1995	1996
1. Spring Chinook (Clackamas Stock)	**$19,356**	**$14,661**	**$10,804**
2. Coho (Tanner Creek Stock, Umatilla releases)	**$61,589**	**$34,095**	**$27,782**
3. Coho (Tanner Creek Stock, Bonneville releases)	**$219,959**	**$143,200**	**$98,781**
4. Coho (Tanner Creek Stock, CEDC release)	**$158,370**	**$88,648**	**$70,999**
5. Coho (Mixed Tanner Creek and Sandy River Stock, CEDC release)	**$0**	**$64,781**	**$108,042**
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**

Table 5a. Annual Operating Expenses: Oxbow Hatchery - Spring Chinook (Clackamas Stock)

Expenditure Occurring at Oxbow Hatchery

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
Program Production (lb)	4,074	5,460	5,096
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	4.4%	4.3%	3.5%
Program Costs	**$19,356**	**$14,661**	**$10,804**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6a. Detailed Expenditures at Oxbow Hatchery by Program

Spring Chinook (Clackamas Stock)

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
Program Production (lb)	4,074	5,460	5,096
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	4.4%	4.3%	3.5%
Program Costs	**$19,356**	**$14,661**	**$10,804**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6b. Detailed Expenditures at Oxbow Hatchery by Program

Coho (Tanner Creek Stock: Umatilla Release)

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
Program Production (lb)	13,553	13,466	13,133
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	14%	10%	9%
Program Costs	**$61,589**	**$34,095**	**$27,782**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6c. Detailed Expenditures at Oxbow Hatchery by Program

Coho (Tanner Creek Stock: Bonneville Releases)

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
I			
Program Production (lb)	46,250	53,748	46,250
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	50%	42%	32%
Program Costs	**$219,959**	**$143,200**	**$98,781**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6d. Detailed Expenditures at Oxbow Hatchery by Program

Coho (Tanner Creek Stock: CEDC Releases)

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
I			
Program Production (lb)	33,000	33,000	33,000
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	36%	26%	23%
Program Costs	**$158,370**	**$88,648**	**$70,999**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6e. Detailed Expenditures at Oxbow Hatchery by Program

Coho (Mixed Tanner Creek and Sandy River Stocks: CEDC Release)

Component	1994	1995	1996
Personnel Costs	$198,941	$190,665	$185,401
Operational Costs	$156,758	$90,519	$57,624
Capital Costs	$15,821	$2,890	$20,842
Indirect Costs	$68,399	$56,878	$44,825
Lumped Hatchery Costs[1]			
Lumped Third-Party Costs	$0	$0	$0
Total Hatchery Costs	**$439,918**	**$340,952**	**$308,692**
Source of Funds			
I			
Program Production (lb)	0	24,000	50,000
Total Production (lb)	91,627	125,332	142,229
Program as Percent of Total	0%	19%	35%
Program Costs	**$0**	**$64,781**	**$108,042**

[1] When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.